

Endogeneity of Currency Areas and Trade Blocs: Evidence from the Inter-War Period

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Abstract

Empirical research on the gravity model of international trade in the wake of Rose (2000) affirms that currency union formation doubles or triples trade. However, currency unions could also be established precisely because trade among their members was already high. In OLS estimation, this would cause endogeneity bias. The present paper employs both fixed effects and binary choice methods to trace endogeneity in the formation of historical currency arrangements. Studying the formation of currency blocs in the 1930s, we find strong evidence of endogeneity. We work with country group fixed effects and find that already in the 1920s, trade within the later currency blocs was up to three times higher than on average. The formal establishment of these blocs had only insignificant or even negative effects on the coefficients. We also employ a probit approach to predicting membership in these later arrangements on the basis of data from the 1920s. Results are remarkably robust and again indicate strong self-selection bias. Evaluated against the control groups, treatment effects in the 1930s were mostly absent. In line with the theory of optimum currency areas, we also find that previous trade integration predicts later membership in currency arrangements. Even the post-war currency arrangements are visible in the inter-war data. Our results strongly caution against optimism about trade creation by currency unions.

Keywords: Currency blocs, gravity model, endogeneity, treatment effects

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I. Introduction

What is the effect of currency unions on international trade? Recent empirical research by Rose [2000, 2001] finds that trade within currency unions is two to three times larger than a gravity model of international trade would predict. The gravity model, now a standard tool of the trade literature see e.g. Anderson [1979], Deardorff [1998], Anderson and van Wincoop [2003], establishes that other things equal, trade between any two countries mainly depends on distance and relative size. Within this model, the measured effect of currency unions on trade is usually large.

But there is also a competing view. It is motivated by the theory of optimal currency areas (OCA), as introduced by Mundell [1961] and McKinnon [1963] and further developed by Frankel and Rose [1997, 1998], Dixit [2000], and Alesina and Barro [2002]. OCA theory argues that trade integration may give rise to monetary integration, as the degree of economic integration between two countries affects the possible welfare gains of a monetary union. This may cause endogeneity bias: national currencies may have been abandoned and a currency union formed precisely *because* trade was already high.

The challenge for empirical research is to identify the discretionary effect of a changing currency arrangement on trade in the presence of anticipation effects. Trade might be high already before the creation of a currency union because agents anticipate their trade creating effect. This anticipation effect would obscure true endogeneity, i.e. the creation of a currency arrangement as an endogenous response to trade integration. One of the key contributions of this paper is to examine a historical episode in which new currency areas formed in the aftermath of a cataclysmic, unexpected event. This allows us to discount anticipation effects, and interpret our results as evidence in favor of endogeneity.

The cataclysmic event to which we refer is the Great Depression and the subsequent collapse of the gold standard. In the aftermath of the Great Depression, the gold standard was replaced by several regional currency blocs. If the formation of these regional currency blocs was unexpected, anticipation effects are likely to be absent from the data. Then, information on trade relations before the Great Depression could serve to identify the effects of the post-depression currency arrangements.

There exists a solid body of literature which argues that the Great Depression was indeed an unexpected event. Hamilton [1987, 1992] has argued that deflation after 1929 came unexpectedly. Dominguez, Fair and Shapiro [1988] examined the performance of contemporary business-cycle forecasts through leading indicators, including a series by Irving Fisher, and found that they fail to predict the recession. Ritschl and Woitek [2001] find that predicting the depression from monetary variables is equally difficult. All these results imply that the gold standard was still credible before 1929 and that anticipation of future currency blocs did not influence agents' behavior.

None of the currency blocs we study in this paper is a currency union in the strict sense. Instead, the blocs which formed in the 1930s range from fixed-exchange rate systems with high capital mobility to networks of bilateral exchange rate agreements with tight capital controls. Nevertheless, these currency arrangements behave very much like currency unions: in naïve cross-section estimation of a gravity model, they exhibit the pretty much the same high coefficients. Combined with the unexpected end of the inter-war gold standard, the formation of these currency blocs thus provides an almost ideal natural experiment.

Eichengreen and Irwin [1995] estimate three separate cross-sectional gravity models for the benchmark years of 1928, 1935, and 1938. They actually do find strong effects of the later currency blocs in their regression for 1928, however without having a clear interpretation for this result. In parts of our paper we build on their results; however we pool our cross-section trade data over the benchmark years. We estimate an augmented version of the gravity model as in Glick and Rose [2002] and Estevadeordal, Frantz and Taylor [2003]. This model can be viewed as a reduced form of different models of trade with solid microfoundations, see Anderson and van Wincoop [2003], Redding and Venables [2001], Eaton and Kortum [2002].

Assessment of this issue is a typical problem in the analysis of treatment effects [on the key issues, see Heckman et al., 1999]. The analyst aims to find out about the effects of exposing an observation unit to a treatment, be it a drug, a training program, or a currency arrangement. Evaluating the effects of any treatment necessarily involves an unobservable counterfactual, namely, the state of the treated observation unit had there been no treatment. There are two principal ways to overcome this problem, either by making the comparison with the individual's state before the beginning (or after the end) of the treatment, or by comparison with a

control group of other observation units not under treatment. The present paper looks into a, possibly unique, historical case where both, the intertemporal and the cross-sectional approaches to identification can be applied without contamination.

The literature on currency arrangements has just begun to pay attention to the proper identification of treatment effects. While initial work of Rose [2000, 2001] consisted in cross-section analysis, recent work has fanned out along both the intertemporal and the cross-section dimension. To use information over the cross section and over time simultaneously, it has become common to apply panel data techniques, see e.g. Glick and Rose [2002] and Rose [2001] for post-war data and Flandreau and Maurel [2001] or López-Córdova and Meissner [2003] for data from the classical gold standard. Recent work of Estevadeordal, Frantz and Taylor [2003] provides a survey of existing applications with historical data. The key finding of Rose, namely that the creation of a currency union has very large trade creating effects, usually survives in these specifications. To improve on the proper choice of a control group, Persson [2001] has proposed a two-stage procedure to the gravity equation, akin to Heckman's Heckit estimator. In a first stage, a binary choice approach is employed to select a suitable control group from common characteristics. In a second stage, the gravity equation measuring the treatment effect is run for a subsample including the both treated and the control group. Restricting comparison to this pre-selected control group, Persson [2001] finds the treatment effects of currency unions to become significantly smaller. We will apply a similar approach in this paper, with even stronger results.

Identification of the treatment effects of a currency arrangement along the intertemporal dimension faces the problem of anticipation effects: trade among the future members of a currency arrangement may rise in the expectation that a formal arrangement will be established in the future. Given the unanticipated breakdown of the gold standard, we can safely rule out such anticipation effects.

Another key contribution of our paper is to analyze the famous currency dummies a little closer. First, in most of our paper we drop the assumption of Glick and Rose [2002] who chose to pool all members of any currency union in their sample into one dummy variable, thus restricting all currency unions to have the same average effect. We will rather adhere to the approach of Eichengreen and Irwin [1995] and measure the trade effect of each currency arrangement separately. Nitsch [2002] has shown that doing so in Rose [2000]'s post-war

dataset, trade creation effects vary substantially. We will find similar effects. Second, we examine the behavior of these dummies over time in order to identify the treatment effect of currency arrangements intertemporally. For each currency area, we define two dummy variables. One is our analog to Andrew Rose's [2000] CU variable. It is equal to one while the formal currency arrangement is operative. The second includes the same country group; however, it is equal to one for the whole sampling period. Essentially, this second dummy is a country group fixed effect. It captures any trade that is higher already *before* a currency bloc is formed (or after it has dissolved).

Introducing country group dummies instead of country pair fixed effects for the trade among members of a currency arrangement has two advantages. First, it allows direct comparison of the group of countries under a currency arrangement with the same reference group before treatment. Second, inclusion of country group dummies increases degrees of freedom and reduces potential collinearity problems. Including a full set of country-pair fixed effects in a panel estimation might be desirable on theoretical grounds, see e.g. Anderson and van Wincoop [2003]. However, there is a deeper identification issue here: as country-pair fixed effects on every trade pair pick up any other time-invariant pair characteristics (such as distance, language, colonial ties, etc.), they make the estimation of a gravity model of trade essentially infeasible.¹ Choosing country group instead of country pair fixed effects is a way to circumvent this problem.

In line with Anderson and van Wincoop [2003] and with the theoretical foundations of the gravity-equation we add to these fixed group effects a set of time-specific country effects. These pick up unobserved price-level effects (or country-specific "multilateral resistance" terms) that were found to bias most empirical results from gravity models.

Estimating the gravity model in the presence of appropriate fixed effects, in this paper we obtain strong evidence in favor of endogeneity. Most of the major currency and trade blocs that formed in the 1930s are visible already in the data from the 1920s. The coefficients on the country group dummies indicate that already prior to the Great Depression, trade among the members of the later blocs was 2-3 times larger than predicted by the gravity model. Those are precisely the orders of magnitude obtained by Rose and his coauthors. We find that controlling for this endogeneity, the effects of actually establishing these currency arrangements in the 1930s are most often insignificant or even negative.

All estimation methods that we employ can be seen as a way of identifying the *treatment effect on the treated* against a counterfactual, the state of the treated in the absence of treatment. As this counterfactual is inherently unobservable, identifying assumptions need to be made to infer the counterfactual from observations on something else. This can be either the group of the treated at different points in time, assuming other characteristics of this group to be constant over time. This is the rationale behind fixed effect estimation, which assumes the group of the treated to be its own control group.

Alternatively, a counterfactual can be constructed by suitable cross-sectional comparison. In the cross-section domain, econometric comparison of the treated group with the control group is prone to be contaminated by two effects. First, the treatment itself may have *indirect effects* on the control group. In the context of trade and currency areas, these indirect effects may consist in trade diversion away from third parties. In the empirical literature on currency areas, the only paper we are aware of that controls for trade diversion is Eichengreen and Irwin [1995], which finds strong such effects during the inter-war period. To the extent that indirect effects are not fully controlled for, measurement of the treatment effect may be biased. Second, the group of the treated may itself not have been randomly selected, leading to endogeneity bias. Fixed effect estimation is only an incomplete way to circumvent this problem, as it critically depends on the time invariance over the panel of any factors causing endogeneity. To tackle this issue, we follow Persson's [2001] binary choice approach to control group selection. The idea here is to find a probability, called the *propensity score*, that a given observation is being selected into the treatment group (the currency arrangement), given a vector of fundamental characteristics. Persson employs this approach to construct a control group for the gravity equation.

In this paper, we employ a related approach to provide a more direct test for the validity of OCA theory. We employ a probit model to test the predictive power of trade patterns in 1928 for the formation of future currency arrangements. To this end we borrow the concept of a client-anchor structure in the formation of currency unions from Alesina and Barro [2002]. Usually, currency arrangements are formed in such a way that client countries fix their currency to the currency of an anchor. OCA theory states that optimally chosen currency areas arise endogenously as a response to previously high trade integration. Trade with the respective anchor countries in 1928 would thus be a predictor for membership in the later currency areas.

We find that 1928 trade with the anchor countries Britain, France, and Germany indeed helps to predict membership in the trade blocs of the 1930s.

Finally, if path dependence of the various trade and currency arrangements was prevalent in the inter-war period, it is natural to ask if post-war European integration was foreshadowed in the inter-war data. It was indeed. Since the choice to join these post-war arrangements were no more mutually exclusive we use simple probit models to test the predictive power of trade-integration. Both the gravity equation and the binary probit approach provide evidence of intense trade among the future members of the postwar European blocs.

The remainder of this paper is structured as follows. Section II introduces the model setup and also discusses data sources and methods. Section III provides a brief review of the historical background. Section IV presents benchmark estimates for the gravity model and shows the effects of endogeneity on the results. Section V turns to the binary choice approach. Section VI examines the possible endogeneity of Europe's post-war institutions, and Section VII concludes with suggestions for further research.

II. Model Setup and Data Sources

The basic idea of the gravity model rests on the observation that other things equal, trade between any two countries is larger the closer they are located. It is customary to control for size and for different per-capita levels of income, employing the log product of the respective country GNPs and per-capita products. The standard gravity equation used by Rose [2000] and many others is a variant of the following specification:

$$(1) \quad TRADE_{ijt} = a_o + a_1 Y_{it} \cdot Y_{jt} + a_2 y_{it} \cdot y_{jt} + a_3 DIST_{ij} + CONTROLS... + u_{ijt}$$

where $TRADE_{ijt}$ is the (log) volume of trade between countries i and j at time t and were Y_{it} and y_{it} are, respectively, the (logs of) total and per-capital output in country i at time t . $DIST_{ij}$ is the log of geographical distance between the two countries, operationalized as the distance between their respective capitals as the crow flies.

To this adds a set of binary control variables, which are intended to capture common characteristics Z , such as common language, common colonial history, common membership in multilateral trade arrangements, and, importantly, a common land border:

$$(2) \quad D_{ij}^{IN} = \begin{cases} 1, & i, j \in Z \\ 0 & \text{otherwise} \end{cases}$$

One such control is Rose's [2000] "CU dummy" for common currency union membership. We will employ this control for membership in the currency blocs that formed in the 1930s, after the gold standard dissolved. None of these blocs is a currency union in the strict sense. Still, we will find that trade within these blocs is up to two or three times higher than on average, just as in the case of strict currency unions.

Evidently, estimation (1) in the presence of (2) from panel data is likely to be plagued by endogeneity problems. Suppose we want to evaluate the effects of a currency arrangement between the country of origin i and the destination country j . For a complete answer, we would need a counterfactual telling us how much these countries would have traded had there been no currency arrangement.

Such a counterfactual is inherently unobservable. Whenever a currency arrangement is in effect, the observed data necessarily "overwrite" any counterfactual data that would have obtained in the absence of a currency arrangement. Evaluation of a currency arrangement therefore rests on identifying assumptions about the unobserved counterfactual.

Estimation without any further controls, sometimes referred to as the *between estimator*, assumes that the indicator variable in (2) fully identifies the treatment effect. Among other things, this involves assuming that the country pairs in the treatment Z do not exhibit any other common characteristics, $\tilde{Z}_t = 0$, all t . On the contrary, the fixed effects or *within estimator* takes care precisely of such common characteristics. Here, the identifying assumption is that for each country pair under the treatment, the idiosyncratic characteristics \tilde{Z}_{ij} are constant over time and uncorrelated to both the controls and the residual: $\tilde{Z}_{ij,t} = \bar{a}_{ij}$, all t . In either case, it is assumed that the unobserved counterfactual can be measured by observing the treated

country pairs before or after the treatment. In this manner, the country pairs under treatment become their own control group in panel estimation.

In the next section, we will apply fixed effects to the analysis of endogeneity in the formation of currency arrangements in the inter-war period. In contrast to the existing literature, we will employ country group dummies instead of country or country pair fixed effects. The specification to be estimated then becomes:

$$(3) \quad \begin{aligned} TRADE_{ijt} &= a_1 + a_1 \text{Country Group Dummy} + \gamma \text{CU Treatment Effect}_s + \delta W_t + u_{ijt} \\ a_{ij} &= 0 \Leftrightarrow \text{Country Group Dummy} = 1 \end{aligned}$$

where W is a vector of nuisance terms. In eq. (3), the country group dummy measures the pre-existing common characteristics of a group of countries that will enter into a currency arrangement at some point during the observation period. In contrast, $\gamma \text{CU Treatment Effect}$ measures the treatment effect of the currency arrangement itself.

In the absence of anticipation effects, a simple classification establishes itself:

$$(4) \quad \begin{aligned} a_1 = 0, \gamma = 0 & \quad \text{CU has no effect} \\ a_1 = 0, \gamma \neq 0 & \quad \text{CU has full effect} \\ a_1 \neq 0, \gamma = 0 & \quad \text{CU entirely endogenous, no additional effect} \\ a_1 \neq 0, \gamma \neq 0 & \quad \text{CU partly endogenous, some additional effect} \end{aligned}$$

Note that it is not relevant for the unbiasedness of the CU coefficient whether country group dummies or country pair fixed effects [as in Glick and Rose, 2002] are chosen, as long all country pairs in the relevant group are included: the country group dummy is a linear combination of the respective country pair fixed effects.

However, the choice between country pair fixed effects and country group dummies does matter crucially for the feasibility of estimating the gravity model (3). A complete set of country pair fixed effects a_{ij} for all countries in the sample would exhaust all degrees of freedom, as it completely characterizes the time-invariant cross-country variation through individual regression constants. In contrast, grouping the relevant countries as in (3) and introducing country

pair fixed effects only for countries not covered by a currency arrangement frees up degrees of freedom and allows for unbiased estimation of the gravity model. This is true even if trade among countries not in a currency arrangement is controlled for by a full set of country pair fixed effects. As an alternative, Estevadeordal, Frantz and Taylor [2003] suggest the use of country fixed effects. This is also consistent with Anderson and van Wincoop [2003], who suggest the use of country fixed effects, interacted with time effects, to account for price level effects in trade not captured by the gravity model. In the sequel, we will employ both methods alongside each other.

For the estimation of gravity models like (1) or (3), different literatures have adopted slightly differing standards. In the literature on currency unions it is customary to employ the average trade volume between countries i and j as the dependent variable. The literature on border effects in trade in the wake of McCallum [1995] has employed trade flows in either direction, thus obtaining two observations per country pair. As Helliwell [1998] argues, this fully utilizes the information from the difference in *fob* and *cif* prices that would be lost in averaging over trade flows. Asymmetry in trade and transport costs is also theoretically important, as in Anderson and van Wincoop [2003]. In this paper, we adhere to this philosophy and include each trade flow as a separate data point.

A potential problem comes in through observed zero trade flows. Arguably, trade between any two countries will only seldom be identically zero. Statistical offices commonly report trade volumes only beyond certain thresholds, which introduces a censorship problem. Eichengreen and Irwin [1995] employed scaled ordinary least squares with $\log(1+trade)$ instead of $\log(trade)$ as the left-hand-side variable. Nitsch [2002] has argued that zero trade observations might introduce potentially large bias into the estimates of Rose [2000]. We follow standard practice on censored data and estimate by Tobit, taking the lowest observed value as the censoring point.

Our estimates combine two different data sets. Trade data were collected by the League of Nations for the benchmark years of 1928, 1935, and 1938 as published in Hilgerdt [1942] and converted to 1936 dollars. GNP data at purchasing power parities are available from Prados de la Escosura [2000] for 29 countries, including the United States, Canada, and most of Europe. We converted output data for the Soviet Union from Maddison [1995] to fit in with

the Prados data set. Per year, this provides 435 country pairs, or 870 observations. Pooled over the three years, the data set includes 2610 observations. Further details on the data are provided in the appendix.

III. Historical background

The onset of the Great Depression in Europe and North America triggered a sharp disintegration of international financial and trading networks. While world industrial production fell within three years to about two-thirds of the 1929 level, world trade in 1932 had declined to some mere 40 percent of the 1929 level [see League of Nations, 1939]. At the same time the direction and patterns of trade were shifted dramatically, changing the traditional multilateral system into a patchwork of regional settlements. For example, the share of Britain's exports to the Commonwealth rose between 1928 and 1938 from 44.4 to about 50 percent, France roughly doubled its import and export shares to colonies and protectorates, and Germany massively increased her trade with South Eastern Europe and Latin America relative to that with other regions [see Eichengreen and Irwin, 1995].

The obvious sources of trade reorientation were regional commercial and monetary arrangements, substituting previous commitment to free trade and adherence to the Gold Standard. However, these regional settlements did not emerge randomly, but rather along pre-existing lines of political preference and economic dependence. When Britain left the Gold Standard in September 1931, the countries for which Britain was a key export market got under pressure to follow suit off gold. Moreover, after the Brussels Conference in 1920 and the Genoa Conference in 1922 had encouraged holding foreign currency instead of gold, there was an incentive for these countries to peg to sterling in order to avoid losses on their sterling reserves [Feinstein, Temin and Toniolo, 1997, p. 151]. Next, shortly after Britain had reneged its commitment to free trade with the Import Duties Act, the Ottawa Agreements in 1932 established preferential trading relations within the Commonwealth. Obviously, trade relations within the Commonwealth had been tight already before 1932, and some authors doubt the importance of those agreements, arguing that already earlier there had been a trend towards growing complementarities between the British economy and the rest of the Empire [see Schlote, 1952; Thorbecke, 1960]. Hence, the actual impact of the Ottawa Agreements on trade is subject to dispute.

Other countries, including Germany, maintained their official gold parities, but restricted convertibility through a system of exchange controls rather than tariffs or quotas. The banking and currency crisis in July 1931 and the sterling devaluation induced a shortage of foreign exchange in many countries. Especially South Eastern and Central European countries, which exported raw materials and agricultural products, experienced a sharp deterioration in their terms of trade while being restricted in access to foreign capital [Nyboe Andersen, 1946, p. 17]. Already in November 1931, a conference of the Danubian countries in Prague held under the auspices of the Bank for International Settlements led to the negotiation of clearing agreements among pairs of exchange-control countries in South Eastern and Central Europe designed to facilitate trade without requiring settlement in international reserves [Eichengreen, 1995]. Germany played a major part in these settlements for two reasons. First, Germany was involved to these clearing agreements as a large regional creditor country, since her traditional economic influence in the area was strengthened by the political and economic collapse of Russia and by the break-up of the Habsburg Empire. But probably more important was Germany's role as one of the world's largest debtor countries after 1918. Immediately after the crisis of July 1931, the German government de facto abandoned the Gold Standard by introducing a rather provisional system of bilateral exchange controls, as other countries did. However, with Germany's economy starting to recover in 1933 and backed by the Nazi ideology of autarky, the bilateral exchange controls were expanded into a systematic trade policy in its own right [Nyboe Andersen, 1946]. In several cases, these bilateral exchange devices evolved into currency pegs to the Reichsmark during the late 1930s [see Milward, 1981]. As a result, there were increasingly rigid trade ties between Central and South Eastern Europe and Nazi Germany. The extent to which these arrangements diverted trade towards Germany is a matter of dispute, [see Ritschl, 2001].

Finally, several countries tried to defend their gold standard parities. France, Belgium, Switzerland, the Netherlands – all former members of the “Union Latine”, a predecessor of the Gold Standard -, and Poland maintained their mutual exchange-rate stability until 1935/6. As their gold currencies grew increasingly overvalued with respect to already devalued currencies, the countries on Gold adopted ever more restrictive tariffs and import quotas to defend these exchange rates. Moreover, the Gold bloc countries often applied “exchange-dumping duties” against countries devaluing their currencies, thereby channelling their trade towards other Gold bloc members [Eichengreen, 1992, ch. 12].

Hence, the observed changes in the patterns of international trade can be traced back to massive institutional changes with the onset of the Great Depression. But apparently, most of these regional settlements emerged along the fault lines of pre-existing patterns of economic and political relationships. This is most evident in the case of Southeast Europe, for which a whole literature on the long-term consequences of the collapse of the Habsburg monarchy has developed (for a controversy among historians on this issue, see Milward [1981] and Wendt [1981]). Any attempt to assess the impact of the arrangements that emerged in the 1930s should take this as a caveat.

IV. Endogeneity of Currency Areas and Trade Blocs: Main Results

This section provides results for the benchmark gravity equation (3) with controls for endogeneity as detailed in (4). Given that the Great Depression and the demise of the gold standard were hard to predict, endogeneity of the currency arrangements of the 1930s should show up in the 1928 data already. As stated above, the gold standard was almost universal before the Great Depression. Among the countries in our sample, only the Soviet Union and Japan were not on gold in 1928. After the Great Depression, everyone reneged on the gold standard, except for five countries that carried on to 1935/6. As a substitute, regional currency and trade blocs formed. The currency agreements and trade blocs we look at were as follows. For the classification and for further references, see Eichengreen and Irwin [1995]:

- (i) *Gold bloc*: five countries that remained on the gold standard to 1936, namely France, the Netherlands, Belgium (to 1935), Switzerland, and Poland
- (ii) *Sterling bloc*: nine countries that left the gold standard in 1931/2 and tied their currencies to the British pound, namely Great Britain, Ireland, Norway, Denmark, Sweden, Finland, Portugal, Australia, and New Zealand.
- (iii) *Commonwealth*: five countries that formed a protectionist tariff area in the Ottawa preferences of 1932, namely Great Britain, Ireland, Canada, Australia, and New Zealand.
- (iv) *Reichsmark bloc*: seven countries formerly on the gold standard that had currency pegs to the reichsmark around 1937/38, namely Germany, Czechoslovakia, Austria, Hungary, Romania, Bulgaria, and Greece.
- (v) *Foreign exchange control*: thirteen countries that maintained foreign exchange agreements with multiple exchange rates with each other and with Germany,

namely Austria, Hungary, Romania, Yugoslavia, Turkey, Italy, Spain, Germany, the Netherlands, Denmark, Norway, Sweden, and Finland [see Ellis, 1941].

Evidently, there existed major overlaps in bloc membership. This implies that the presence of other, competing arrangements need to be accounted for in order to evaluate the effects of any single bloc properly. Moreover, not all blocs were currency areas, and where they were, the relationship to a currency union was sometimes far less than obvious (as is the case with the German-led reichsmark and foreign exchange control blocs).

Taking Rose [2000]; Rose and van Wincoop [2001] literally, these arrangements would hardly qualify as currency unions. Likewise, the character of the gold standard as a currency union could be questioned [but see Flandreau and Maurel, 2001, and López-Córdova and Meissner, 2003]. All this would imply that the effects of these arrangements were markedly smaller than the magnitudes obtained by Rose [2001, 2002]. However, this is not the case, as Table I bears out.

(Table I about here)

The estimates in Table I are all by Tobit, correcting for the censored distribution of the dependent variable. Table I shows the coefficients on the various currency and trade blocs of the 1930s in pooled regressions for the benchmark years of 1928, 1935, and 1938. In Table I, this is done as in the literature, except that Table I has a dummy variable for each currency arrangement separately. As in the literature, each of these dummy variables equals one while the currency arrangement is active, and is zero otherwise. As can be seen, many of the coefficients on the currency and trade blocs are remarkably close to the CU coefficients reported by Rose, e.g. in Rose [2002], ranging from .4 in one specification for the Sterling bloc to 1.26 for the Reichsmark bloc. This appears to reproduce Rose's results: trade among the members of a currency bloc is up to three times higher than the gravity model would predict. We also see that not all arrangements come out with coefficients that high: the exchange control bloc apparently had no trade effects at all, while those of the gold bloc appear uncertain.

The difficulty with the estimates in Table I is in the practicalities of fixed effect estimation. The currency arrangements in question are groups of country pairs, hence the proper choice of fixed effects would be all country pairs in question. an appropriate set of fixed effects would, however, exhaust almost all degrees of freedom for time-invariant effects in the equation and render estimation of the gravity model impossible. Table I includes country pair fixed effects only for the remaining ten (out of 435) country pairs not covered by any currency or trade arrangement in our sample in the 1930s.

Under this choice, whether or not fixed effects are included does not change the broad picture. This is consistent with the observation of Glick and Rose [2002] and Rose [2002] that minor alterations to the gravity equation do not affect its principal quantitative conclusions.

To get a proper grip on the panel dynamics, in Table II we therefore introduce interaction terms between the currency area variables and the time dummies for the 1930s. For each currency bloc, the respective interaction dummy ($XXX*treatment1930s$) is equal to one for the period when the currency blocs were actually in effect. At the same time, the country group dummy XXX plays the role of a country group fixed effect.

(Table II about here)

In the presence of this country group fixed effect, the coefficient of this interaction dummy for the 1930s thus measures the impact of actually introducing the respective currency arrangement. Under the modified null and alternative hypotheses derived in the previous section, a currency arrangement only had actual effects if this coefficient is significantly different from zero.

Table II again we presents alternative sets of estimates, one without added fixed effects, one with (time-varying) country fixed effects, and one with country-pair or bilateral fixed effects for the ten country pairs not included in any currency arrangement.

Compared to Table I, nearly all the group dummies now take on higher values, close to the magnitudes found by Rose. However, there is a catch to all this: given that we now control for the 1930s separately for each currency bloc, the coefficients on the blocs themselves are valid

only for the benchmark year of 1928, three years before the gold began to collapse. In 1928, none of the later currency arrangements was operative; all countries in the sample except for the USSR and Japan were on the gold standard. Even among the countries of the later gold bloc, trade was 1.6 to 1.8 times higher in 1928 than for the rest of the sample, at least in the estimate with country fixed effects. Eichengreen and Irwin [1995] argue that all these later blocs were somehow active already in the 1920s. This may be true for the Commonwealth, although a shift to tariff protection that might explain this occurred only in 1932. We doubt, however, that a similar point could be made for the other blocs under consideration.

In contrast to the mostly very high dummies for the 1920s, the treatment effects measured by the interaction dummies for the 1930s are low or even negative. Sometimes, the effects also cancel each other out. This is particularly true of the Commonwealth and the Sterling bloc in the 1930s, whose membership overlapped strongly. Being in the Sterling zone in the 1930s was a bad idea, although the coefficients from the 1920s predicted massive trade creation. However, the losses are outweighed by the massive benefits from being in the Commonwealth in the 1930s. The same is true of Germany's Reichsmark bloc. Being in this zone-to-be was extremely beneficial during the gold standard of the 1920s, but no further gains were made in the 1930s.

Trade among countries that stayed on gold clearly fared better in the 1930s than the average. Once we control for the break-up of the gold bloc in 1936, we see that being a member of the later gold bloc in 1928 implies no path dependence: trade among these countries in 1928 was just average. We find it remarkable, though, that the break-up (after-treatment) effects of the gold bloc are so different from the pre-treatment fixed effect. There is an asymmetry between before- and after-treatment, which invalidates the fixed effects model of the gold bloc in the second and third column. In passing we note that there is some, albeit insignificant evidence for trade creation among the members of the German-dominated bilateral exchange control system in the 1930s. This result is surprising in the light of the devastating criticism of this system by Ellis [1941] and Child [1958].

The interaction dummies in Table II suggests that all currency blocs of the 1930s are highly endogenous, except for the gold bloc. In the gold bloc of those countries that stayed on gold to the mid-1930s, there is now significant trade creation during the 1930s. Notice that neither the Sterling bloc nor the reichsmark bloc show any trade creation in the 1930s: with the exception

of one insignificant coefficient, the signs on the respective coefficients are negative throughout.

Endogeneity also yields quantitatively impressive results. For the later Reichsmark zone, trade in the 1920s was between 2.4 and 4 times higher in the 1920s than the gravity model would predict. For the Sterling zone, this effect varies between 1.6 and 3.7. With country fixed effects and without country fixed effects, the coefficients appear to be higher in the Tobit regressions than in the OLS regression with dummies controlling for censoring. Whatever these refinements (we tried many more), they only strengthen the main result: currency blocs do not necessarily create trade. Instead, trade often creates currency blocs.

V. Does Trade Create Currency Blocs? A Binary Choice Approach

Thus far we have estimated the effect of currency arrangements on trade while controlling for endogeneity. Evidence indicates that causation may go either way: as suggested by Rose, currency arrangements have considerable trade-creating effects. However, the persistence of trade relations is quantitatively even more important. There are two possible interpretations for this result: first, there is a case for path-dependent trade flows. Second and more excitingly, the creation of currency arrangements seems to depend at least in part on the existing pattern of international trade. The theory of optimal currency areas (OCA) developed by Mundell [1961], and especially the contribution of McKinnon [1963] motivates us to take this view seriously. Among other things, OCA theory suggests that the possible welfare gains of adopting a common currency increase in the degree of economic integration between two states. If this holds, one can predict future currency areas from historical trade patterns. Obviously we expect to find a lot of noise in this prediction: each currency arrangement has its own political history, and even OCA theory tells us that trade integration is only part of the story. But it might be an important one.

In this section we adopt a binary choice approach toward predicting currency bloc formation from trade in 1928. Our approach is motivated by Persson's [2001] criticism of the gravity approach to currency unions. Persson [2001] proposed a two-step matching approach to tackle the issue of endogeneity. He argues for the need to create a proper control group of trading partners that may or may not be part of a same currency arrangement. Persson does this by estimating the probability for a country pair to join a currency union, given a list of pairwise

characteristics as in the usual gravity equation. Similarly, Barro and Tenreyro [2003] estimate the probability of a country pair to join a currency union in order to derive instruments for the currency-union dummies in a gravity framework.

As in the previous sections, we exploit the dynamics of the panel to achieve exogeneity, which allows us to directly assess the predictive power of today's trade-flows for tomorrow's currency arrangements. That is, our approach differs from that of Persson [2001] and Barro and Tenreyro [2003] in that we do not primarily use the binary choice approach to improve the gravity estimates. Here, we do rather the opposite: we use a gravity model to assess the impact of economic integration on the probability of joining a certain currency arrangement.

We want to predict the formation of currency arrangements from historical trade patterns, or to be strict, from the history of economic integration between trading partners. Since the work of Hamilton and Winters [1992], Frankel and Wei [1993], and Baldwin [1994], the gravity model is the standard tool for assessing the degree of economic integration between countries. The gravity variables permit estimation of potential trade levels between countries. Deviations from observed trade may then be interpreted as a proxy for economic integration or lack thereof. This provides a simple and straightforward way to test the OCA hypothesis. If the hypothesis holds, the level of bilateral trade in 1928 should help to predict future membership in the currency arrangements, even after controlling for the gravity variables as specified in section III. As the currency arrangements in question were all formed during or after the Great Depression, and as the Great Depression was unforeseen, trade in 1928 can safely be regarded as exogenous.

From Alesina and Barro [2002] we borrow the idea that currency arrangements often form around anchor countries. This concept has an obvious application to the political rivalry among Europe's powers since the late 19th century and after World War I. We would expect any currency arrangements in the inter-war period to follow these political fault lines.

We estimate separate binary choice models for all currency blocs under consideration. The dependent variable in these regressions is the binary country group dummy X_{ij}^{IN} , $i, j \in Z$ defined above in eq. (2), which takes the value of one if both countries i and j will later be members of the same currency arrangement. The regressors are the observed bilateral trade

flows of 1928, controlled for potential trade as implied by the 1928 gravity variables. Table III provides the resulting probit estimates for membership in the various currency arrangements.

(Table III about here)

Consider the reported coefficients on bilateral trade with potential anchor countries, which capture the predictive power of economic integration in 1928 for future bloc membership. As can be seen, most of the currency blocs of the 1930s can be well explained and predicted through the concept of an anchor country. Countries that traded intensely with Britain in 1928 were highly likely to be members of the Sterling bloc in the 1930s. The same is true of the Commonwealth. In the latter equation, language created an almost perfect match and was therefore omitted. Countries with high German trade were likely to be members of the reichsmark bloc in the 1930s. However, there is a high level of noise in some of these predictions. Trade with anchor countries in 1928 does not help much to predict the future gold bloc of the 1930s, which consisted of five European countries staying on gold to 1935/6. Actually, this seems to reflect the fact that almost by definition, the gold bloc was not a preferential currency agreement but rather the continuation of the old multilateral trading system². Trade patterns predicting the exchange rate bloc are also surprising: lack of trade with Britain appears to be far more important than trade with Germany, the supposed anchor country of that bloc. Also, the coefficient on trade in general is negative in this equation. This coefficient captures trade integration with other than the three anchor countries. Countries later in the exchange control bloc were on the whole less integrated into the international economy. This implies that trade dependence on Germany, which was instrumental in Germany's aggressive trade policies of the 1930s, was again path dependent, which confirms results of Ritschl [2001].

Thus, trade integration with the regional anchor countries in 1928 helps to predict the creation of currency arrangements in the 1930s. There is obviously a significant amount of self selection along political and historical fault lines, which predetermined bloc formation and regional trade creation in the 1930s. Indeed, the treatment effects of bloc creation in the 1930s almost disappear when evaluated against the control groups created by self-selection (Table IV).

(Table IV about here)

Table IV examines trade creation in the gravity model again, just as in Table II above. Here, however, attention is limited to the 1930s, and to the control groups created through the binary choice models in Table III. Combining these and the group of the treated into a reference group, Table IV estimates trade creation in the 1930s among both the reference group and the actually treated. Relative to the control group, trade creation among the actual members of any trade or currency blocs is insignificant or even negative, except possibly for the Sterling bloc. Note that this result is robust to changes in specifications and estimation methods.

Drawing the results of this section together, trade within the currency and trade blocs of the 1930s is predicted and quantitatively well explained by self-selection of trade relations with anchor countries in the 1920s. Again, the treatment effect mostly disappears from the gravity model once the proper comparisons to countries with similar characteristics are made. Not only do currency areas create trade, but trade also creates currency areas. This is what the theory of Optimum Currency Areas (OCA) has always predicted.

VI. Predicting Europe's Post-War Integration

In this section, we briefly glance at the effects of including three institutions of post-war Europe into our estimates. It seems obvious that World War II was such a major divide in European economic trends that such an undertaking must be hopeless from the beginning. Eichengreen and Irwin [1996] examined post-war European trade flows and found that data from the early 1950s are generally poor predictors of later institutions like the EEC or the EU. Surprisingly, the outlook from the inter-war period is better. Table V examines the effects of extending the gravity equations from Tables I and II to include the EEC, the EU, and the Eurozone.

(Table V about here)

Results again depend on whether or not trade diversion is included. On the whole, the EEC of six members, founded in 1957 by France, Italy, the Benelux countries, and West Germany, comes out very strongly and robustly. The trade creation coefficient is around .9 if trade creation and trade diversion are included separately. This means that in the inter-war years, members of the later EEC already 2.5 times as much with each other as the gravity model would predict, even taking into account all the institutions that existed back then. Notice the strong

reverse trade diversion effects: the later members of the EEC used to trade far *more* with third countries than the gravity model would predict. Not accounting for trade diversion, the two effects partially outweigh each other, thus obfuscating the double-faced nature of biases in inter-war trade relations. In the last three columns of Table V, the trade creation coefficient on the EEC becomes far smaller. Trade creation plays no role for the EU of fifteen as of the year 2000. However, reverse trade diversion does. Looking at the Eurozone, there is even some evidence of *negative* trade creation during the inter-war years. All these results come out more or less unchanged upon changes in the specification and in controls. Quite evidently, the dominant issue is with the EEC and its impressive degree of endogeneity. Taking the evidence at face value, extending and deepening European integration runs into something like diminishing returns to path dependence.

We may also apply the binary probit approach to postwar integration. As in Table III above, we employ the gravity model as a set of controls and use the concept of Europe's three anchor countries. To account for potential member countries that were locked out by the Cold War, we control for all countries in the sample behind the Iron Curtain after 1945 (Table VI).

(Table VI about here)

The probit models in Table VI achieve very satisfactory hit rates. At a cutoff probability of 0.5, more than 70% of all trade pairs within the respective arrangement are identified correctly. Large parts of the explanatory power fall on the variables of the gravity model, including distance (shown) and output (not shown). We found this result to be quite robust to changes in the specifications. We also note that the probits for 1928 do a much better job at predicting the postwar arrangements than the trade and currency blocs of the 1930s. At the risk of overstressing the evidence, we see this as consistent with the view that Europe's postwar institutions were a hugely more rational way of organizing European trade and payments than the makeshift arrangements of the 1930s, [see Eichengreen, 1993, 1996].

VII. Endogeneity of Currency Areas: Concluding Remarks

Data from the inter-war period suggest that currency areas are highly endogenous. In this paper, we have studied the persistence of regional trade across the Great Depression, the collapse of the Gold Standard, and the establishment of various regional currency and trade

blocs. These currency areas are not currency unions in the strict sense. Nevertheless, Andrew Rose-type gravity equations on the effects of these currency arrangements reproduce the standard result of very high trade creation among their members. However, controlling for pre-existing trade patterns before these currency areas were formed, we find strong evidence of endogeneity: between half and more than 100% of the trade among the members of a currency arrangement existed already before the arrangement was created.

The theory of Optimum Currency Areas would predict that not only do currency areas create trade but that trade also creates currency areas. Our results lend strong support to that view. In a panel data set with observations both from the 1920s, when the gold standard was in place, and the 1930s, when the Great Depression had destroyed it, we find that trade among future currency area members was already very high in the 1920s. In a gravity model with proper controls, the actual effect of establishing a given arrangement in the 1930s is generally small and sometimes even negative. This result is very robust to changes in specifications. Using a binary choice model, we also find that trade patterns in the 1920s predicts currency area membership in the 1930s quite well.

Path dependence of potential trade and currency areas seems to be an enduring phenomenon in Europe across World War II. Using the methods employed for the 1930s, we find evidence that strong trade patterns survived also into the postwar period. While there is a quantitatively important role for the later EEC in European trade patterns already in the 1920s, the other postwar arrangements play a less important role. Again, the binary probit approach yields very robust results and does an even better job than for the 1930s.

Our results offer an easy and quantitatively important interpretation of Rose's results: Trade among the members of a currency areas may be two to three times higher than a gravity equation would predict. We obtain this result as well. But maybe this has nothing to do with trade creation: almost all of it disappears once pre-existing trade flows are properly accounted for. It seems that trade also creates currency areas, not just the other way round.

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¹ This point is also made by Esteveordal, Frantz, and Taylor [2003].

² In the gold bloc equation, the border with Germany would have created an almost perfect match and was therefore omitted.

TABLE I
 NAÏVE PANEL REGRESSIONS FOR TRADE EFFECTS OF INTERWAR CURRENCY
 BLOCS, 1928-1938

| dependent: LOG(TRADE) | -- Tobit -- | | |
|---------------------------------------|--------------------------------|--------------------------|-------------------------------|
| | no additional fixed effects | country fixed effects | country pair fixed effects |
| LOG(DIST) | -0.473 <i>-10.494</i> | -0.907 <i>-10.480</i> | -0.480 <i>-10.678</i> |
| COMMON_IN | 1.362 <i>5.467</i> | 1.726 <i>8.453</i> | 1.275 <i>5.514</i> |
| STERLING_IN | 0.416 <i>3.566</i> | 0.607 <i>5.542</i> | 0.434 <i>3.827</i> |
| GOLD_IN | 0.792 <i>9.812</i> | -0.032 <i>-0.286</i> | 0.768 <i>9.333</i> |
| GOLD_IN(<i>AFTER TREATMENT</i> 1938) | -0.335 <i>-3.512</i> | 0.024 <i>0.166</i> | -0.339 <i>-3.527</i> |
| RM_IN | 0.899 <i>8.134</i> | 1.256 <i>9.608</i> | 0.892 <i>8.080</i> |
| EXCH_IN | 0.073 <i>1.078</i> | 0.299 <i>3.758</i> | 0.073 <i>1.085</i> |
| No. of observations | 2136 | 2136 | 2136 |
| Left censored observations | 229 | 229 | 229 |
| Adjusted R-squared | 0.681 | 0.798 | 0.691 |
| Log likelihood | -3005.1 | -2451.6 * | -2942.2 |
| SEE | 0.947 | 0.752 | <i>0.932</i> |
| Mean dependent var | 2.526 | 2.526 | 2.526 |
| S.D. dependent var | 1.676 | 1.676 | 1.676 |

z statistics for censored normal distribution in italics

* statistics refer to censored logistic distribution

Gravity controls in the equations (not reported): Y_i , Y_j , y_i , y_j , $border_{ij}$, $language_{ij}$. All those and log distance have interaction terms with time effects for 1930s. Country fixed effects have interaction terms with time effects. Where indicated, country pair fixed effects are included for observations not covered by currency and trade area dummies.

TABLE II
ENDOGENEITY OF INTERWAR CURRENCY BLOCKS, PANEL 1928-1938

| | -- Tobit -- | | |
|--|--------------------------------|--------------------------|-------------------------------|
| | no additional fixed effects | country fixed effects | country pair fixed effects |
| LOG(DIST) | -0.459 <i>-10.038</i> | -0.839 <i>-7.896</i> | -0.458 <i>-9.976</i> |
| LOG(DIST)(<i>TREATMENT1930s</i>) | 0.007 <i>0.123</i> | 0.172 <i>1.375</i> | -0.022 <i>-0.400</i> |
| COMMON_IN | 1.161 <i>3.135</i> | 1.409 <i>4.066</i> | 0.961 <i>2.590</i> |
| COMMON_IN(<i>TREATMENT 1930s</i>) | 0.197 <i>0.443</i> | 0.309 <i>0.770</i> | 0.355 <i>0.814</i> |
| STERLING_IN | 0.592 <i>3.801</i> | 0.555 <i>3.364</i> | 0.477 <i>3.049</i> |
| STERLING_IN(<i>TREATMENT1930s</i>) | -0.175 <i>-0.899</i> | 0.053 <i>0.269</i> | -0.025 <i>-0.131</i> |
| GOLD_IN | 0.162 <i>1.752</i> | -0.364 <i>-2.399</i> | 0.139 <i>1.544</i> |
| GOLD_IN(<i>TREATMENT1930s</i>) | 0.631 <i>5.145</i> | 0.329 <i>1.748</i> | 0.635 <i>5.180</i> |
| GOLD IN(<i>AFTER TREATMENT 1938</i>) | -0.334 <i>-3.504</i> | 0.029 <i>0.196</i> | -0.347 <i>-3.533</i> |
| RM_IN | 1.095 <i>9.244</i> | 1.388 <i>6.453</i> | 1.024 <i>9.419</i> |
| RM_IN(<i>TREATMENT1930s</i>) | -0.196 <i>-1.214</i> | -0.130 <i>-0.517</i> | -0.116 <i>-0.764</i> |
| EXCH_IN | -0.042 <i>-0.431</i> | 0.243 <i>1.815</i> | -0.066 <i>-0.669</i> |
| EXCH_IN(<i>TREATMENT1930s</i>) | 0.116 <i>0.976</i> | 0.058 <i>0.375</i> | 0.147 <i>1.230</i> |
| No. of observations | 2136 | 2136 | 2136 |
| Adjusted R-squared | 0.692 | 0.811 | 0.700 |
| Log likelihood | -2970.8 | -2393.9 * | -2943.8 |
| Mean dependent var | 2.526 | 2.526 | 2.526 |
| SEE | 0.930 | 0.634 | 0.918 |
| Censored obs. | 229 | 229 | 229 |

Tobit estimates: z statistics for censored normal distribution in italics

** statistics refer to censored logistic distribution*

Gravity controls in the equations (not reported) as in Table I.

TABLE III
PREDICTING CURRENCY BLOC MEMBERSHIP FROM BINARY PROBIT MODEL OF TRADE IN 1928

| | Gold Bloc | Commonwlth | Sterling Bloc | ExchCtrl Bloc | RM Bloc |
|--------------------------------------|-------------------------|------------------------|-------------------------|-------------------------|-------------------------|
| LOG(DIST) | -1.581 <i>-3.784</i> | 0.828 <i>3.328</i> | 0.378 <i>2.713</i> | -0.997 <i>-6.489</i> | -0.270 <i>-0.911</i> |
| LOG(TRADE 1928) | 0.155 <i>0.597</i> | 0.641 <i>2.398</i> | 0.306 <i>1.884</i> | -0.197 <i>-2.240</i> | 0.908 <i>4.495</i> |
| LOG(TRADE 1928)*FR | -0.054 <i>-0.430</i> | -4.114 <i>0.000</i> | -4.322 <i>0.000</i> | -5.924 <i>0.000</i> | -2.891 <i>0.000</i> |
| LOG(TRADE 1928)*UK | -2.597 <i>0.000</i> | 0.297 <i>2.410</i> | 0.757 <i>6.268</i> | -0.614 <i>-4.545</i> | -2.202 <i>0.000</i> |
| LOG(TRADE 1928)*GE | -2.672 <i>0.000</i> | -2.365 <i>0.000</i> | -2.249 <i>0.000</i> | 0.120 <i>2.009</i> | 0.311 <i>3.525</i> |
| BORDER | -1.856 <i>-2.415</i> | 1.002 <i>1.265</i> | 0.814 <i>1.690</i> | -0.352 <i>-1.365</i> | -0.589 <i>-1.637</i> |
| BORDER*GE | | -6.613 <i>0.000</i> | -8.151 <i>0.000</i> | -1.572 <i>-5.711</i> | -0.332 <i>-0.749</i> |
| LANGUAGE | 1.347 <i>1.586</i> | | -0.276 <i>-0.618</i> | -1.136 <i>-1.839</i> | 0.732 <i>1.231</i> |
| McFadden R-squared | 0.570 | 0.641 | 0.580 | 0.390 | 0.539 |
| Log likelihood | -40.951 | -34.206 | -104.301 | -249.583 | -77.641 |
| Restr. log likelihood | -95.224 | -95.224 | -248.347 | -409.201 | -168.264 |
| LR statistic (19/18 df) | 108.546 | 122.035 | 288.092 | 319.236 | 181.247 |
| Hannan-Quinn criter. | 0.178 | 0.162 | 0.328 | 0.662 | 0.266 |
| Obs. w/ depvar = 1 | 20 | 20 | 72 | 156 | 42 |
| Pred. as depvar = 1 [cutoff p = 0.4] | 10 | 11 | 50 | 97 | 19 |
| % correct | 50.0 | 55.0 | 69.4 | 62.18 | 45.24 |
| Obs. w/ depvar = 0 | 850 | 850 | 798 | 714 | 828 |
| Pred. as depvar = 0 | 847 | 847 | 779 | 627 | 813 |
| % correct | 99.7 | 99.7 | 97.6 | 87.82 | 98.2 |

z statistics in italics

controls (nor reported): gravity eq., small-trade bias, GL index, country dummies for USSR, US, Argentina, Japan

TABLE IV
TREATMENT EFFECTS RELATIVE TO CONTROL GROUP, 1930s

| | log of trade | | |
|------------------------------|--------------------------|--|--------------------------------|
| | country fixed effects | Tobit country pair fixed effects | |
| | | | no additional fixed effects |
| LOG(DIST) | -0.659 <i>-18.782</i> | -0.450 <i>-13.487</i> | -0.466 <i>-14.909</i> |
| GOLD BLOC | | | |
| <i>REFERENCE GROUP</i> | 0.768 <i>1.948</i> | 0.934 <i>2.325</i> | 0.970 <i>2.352</i> |
| <i>TREATMENT EFFECT</i> | -0.116 <i>-0.291</i> | -0.091 <i>-0.225</i> | -0.105 <i>-0.252</i> |
| <i>REFERENCE GROUP_1938</i> | -0.804 <i>-1.662</i> | -0.903 <i>-1.812</i> | -0.913 <i>-1.783</i> |
| <i>TREATMENT EFFECT_1938</i> | 0.654 <i>1.329</i> | 0.634 <i>1.257</i> | 0.636 <i>1.218</i> |
| COMMONWEALTH | | | |
| <i>REFERENCE GROUP</i> | 2.251 <i>11.379</i> | 1.732 <i>8.270</i> | 1.750 <i>8.346</i> |
| <i>TREATMENT EFFECT</i> | -0.644 <i>-2.101</i> | -0.435 <i>-1.323</i> | -0.505 <i>-1.555</i> |
| STERLING BLOC | | | |
| <i>REFERENCE GROUP</i> | 0.406 <i>1.832</i> | 0.000 <i>0.001</i> | 0.023 <i>0.108</i> |
| <i>TREATMENT EFFECT</i> | 0.236 <i>1.018</i> | 0.474 <i>2.084</i> | 0.480 <i>2.131</i> |
| EXCHANGE CONTROL BLOC | | | |
| <i>REFERENCE GROUP</i> | 0.050 <i>0.662</i> | 0.088 <i>1.155</i> | 0.082 <i>1.084</i> |
| <i>TREATMENT EFFECT</i> | 0.019 <i>0.229</i> | 0.002 <i>0.026</i> | 0.004 <i>0.042</i> |
| REICHSMARK BLOC | | | |
| <i>REFERENCE GROUP</i> | 1.271 <i>8.464</i> | 1.278 <i>8.536</i> | 1.393 <i>9.586</i> |
| <i>TREATMENT EFFECT</i> | -0.312 <i>-1.787</i> | -0.271 <i>-1.546</i> | -0.335 <i>-1.982</i> |
| No. of observations | 1421 | 1421 | 1421 |
| Degrees of freedom | 1398 | 1396 | 1403 |
| Adjusted R-squared | 0.729 | 0.684 | 0.676 |
| Mean dependent var | 2.278 | 2.278 | 2.278 |
| SEE | 0.807 | 0.873 | 0.883 |
| Censored obs. | 172 | 172 | 172 |

Reference group includes control group and treated

t statistics in italics

Gravity controls (not reported) as in Table 1

TABLE V
 ENDOGENEITY OF EUROPE'S POSTWAR INSTITUTIONS, FULL MODEL, PANEL 1928-1938

| Dependent variable: Estimation method: | Logarithm of zero-value adjusted trade volume OLS with controls for small-scale bias | | | | | | Logarithm of trade Tobit | | | |
|--|---|-------------------------|--------------------------|-------------------------|----------------------------|-------------------------|-----------------------------|-------------------------|-------------------------|-------------------------|
| | No additional fixed effects | | Country fixed effects | | Country pair fixed effects | | | | No fixed effects | |
| LOG(DIST) | -0.295 <i>-6.996</i> | -0.196 <i>-4.973</i> | -0.432 <i>-10.214</i> | -0.312 <i>-7.874</i> | -0.300 <i>-7.061</i> | -0.214 <i>-5.382</i> | -0.350 <i>-7.100</i> | -0.243 <i>-5.124</i> | -0.347 <i>-7.083</i> | -0.227 <i>-4.817</i> |
| EEC OF SIX(1957)_IN | 0.902 <i>7.235</i> | 0.556 <i>4.824</i> | 0.972 <i>8.079</i> | 0.552 <i>4.714</i> | 0.929 <i>7.439</i> | 0.605 <i>5.254</i> | 0.757 <i>5.231</i> | 0.531 <i>4.073</i> | 0.742 <i>5.126</i> | 0.492 <i>3.772</i> |
| EU OF FIFTEEN(2000)_IN | 0.137 <i>1.348</i> | 0.348 <i>3.244</i> | 0.113 <i>1.160</i> | 0.465 <i>4.412</i> | 0.134 <i>1.311</i> | 0.359 <i>3.324</i> | 0.090 <i>0.733</i> | 0.267 <i>2.112</i> | 0.097 <i>0.787</i> | 0.253 <i>2.004</i> |
| EURO ZONE_IN | -0.229 <i>-2.715</i> | -0.281 <i>-3.190</i> | -0.266 <i>-3.367</i> | -0.356 <i>-4.188</i> | -0.233 <i>-2.749</i> | -0.291 <i>-3.291</i> | -0.274 <i>-2.523</i> | -0.377 <i>-3.298</i> | -0.277 <i>-2.563</i> | -0.374 <i>-3.280</i> |
| EEC57 OF SIX (1957)_OUT | 0.399 <i>6.156</i> | 0.202 <i>3.522</i> | 0.484 <i>7.956</i> | 0.244 <i>4.285</i> | 0.413 <i>6.346</i> | 0.232 <i>4.025</i> | 0.418 <i>5.468</i> | 0.284 <i>4.135</i> | 0.414 <i>5.415</i> | 0.265 <i>3.857</i> |
| EU OF FIFTEEN(2000)_OUT | 0.162 <i>2.658</i> | 0.286 <i>4.441</i> | 0.172 <i>3.149</i> | 0.394 <i>6.440</i> | 0.157 <i>2.573</i> | 0.296 <i>4.563</i> | 0.137 <i>1.773</i> | 0.239 <i>2.931</i> | 0.142 <i>1.837</i> | 0.224 <i>2.751</i> |
| EURO ZONE_OUT | -0.072 <i>-1.143</i> | -0.096 <i>-1.461</i> | -0.083 <i>-1.506</i> | -0.155 <i>-2.545</i> | -0.056 <i>-0.892</i> | -0.085 <i>-1.275</i> | -0.069 <i>-0.868</i> | -0.104 <i>-1.224</i> | -0.087 <i>-1.094</i> | -0.120 <i>-1.428</i> |
| Currency Arrangements in the Equation | yes | no | yes | no | yes | no | yes | no | yes | no |
| Treatment Effects of Currency Arrangements in the Equation | yes | no | yes | no | yes | no | yes | no | yes | no |
| No. of observations | 2610 | 2610 | 2610 | 2610 | 2610 | 2610 | 2136 | 2136 | 2136 | 2136 |
| No. of left-censored observations | | | | | | | 229 | 229 | 229 | 229 |
| Adjusted R-squared | 0.969 | 0.965 | 0.972 | 0.968 | 0.969 | 0.966 | 0.728 | 0.694 | 0.725 | 0.688 |
| SEE | 0.850 | 0.896 | 0.799 | 0.859 | 0.842 | 0.885 | 0.873 | 0.928 | 0.879 | 0.936 |
| Mean dependent var | 0.395 | 0.395 | 0.395 | 0.395 | 0.395 | 0.395 | 2.526 | 2.526 | 2.526 | 2.526 |
| S.D. dependent var | 4.773 | 4.773 | 4.773 | 4.773 | 4.773 | 4.773 | 1.676 | 1.676 | 1.676 | 1.676 |

t statistics from White standard errors in italics (columns 1 to 6)

z statistics from Hubert-White standard errors in italics (columns 7 and 8)

EEC of 6: Trade between France, Germany, Italy, Netherlands, Belgium/Luxembourg

EU of 15: Trade between EEC countries plus Portugal, Spain, Greece, Ireland, Britain, Denmark, Sweden, Finland, and Austria

Euro zone: Trade between EU 15 members except for Denmark and Sweden

Gravity controls in the equations (not reported): Y_i , Y_j , y_i , y_j , $border_{ij}$, $language_{ij}$, small trade volume dummy STD_{ij} , $STD_{ij} * \log(dist)_{ij}$, $STD_{ij} * Y_{ij}$.

All gravity controls have slope dummies for 1930s. Cols. 2 to 8 with fixed effects for observations not covered by currency and trade area dummies.

TABLE VI
 PREDICTING POSTWAR EUROPEAN INTEGRATION
 FROM BINARY PROBIT MODEL OF TRADE IN 1928

| | EEC of Six (1957) | EU of Fifteen (2000) | Euro Zone |
|-----------------------|-------------------------|-------------------------|-------------------------|
| LOG(DIST) | -3.979 <i>-3.166</i> | -1.436 <i>-8.272</i> | -1.331 <i>-7.082</i> |
| LOG(TRADE 1928) | -0.129 <i>-0.288</i> | -0.228 <i>-2.124</i> | -0.136 <i>-1.229</i> |
| LOG(TRADE 1928)*FR | -0.008 <i>-0.076</i> | 0.079 <i>1.132</i> | 0.104 <i>1.514</i> |
| LOG(TRADE 1928)*UK | -2.415 <i>0.000</i> | 0.116 <i>1.783</i> | -0.496 <i>-4.029</i> |
| LOG(TRADE 1928)*GE | -0.228 <i>-1.469</i> | 0.057 <i>0.905</i> | 0.082 <i>1.281</i> |
| BORDER | -1.422 <i>-1.668</i> | -0.683 <i>-1.882</i> | -0.837 <i>-2.309</i> |
| LANGUAGE | -3.516 <i>-2.279</i> | -0.912 <i>-2.000</i> | -0.629 <i>-1.229</i> |
| McFadden R-squared | 0.750 | 0.556 | 0.519 |
| Log likelihood | -22.853 | -157.594 | -134.746 |
| Restr. log likelihood | -91.249 | -354.998 | -280.138 |
| LR statistic | 136.792 | 394.807 | 290.784 |
| Hannan-Quinn criter. | 0.153 | 0.530 | 0.466 |
| Obs. w/ depvar = 1 | 20 | 141 | 95 |
| Pred. as depvar = 1 | 14 | 103 | 55 |
| % correct | 70.0 | 73.1 | 57.9 |
| Obs. w/ depvar = 0 | 695 | 574 | 620 |
| Pred. as depvar = 0 | 692 | 533 | 601 |
| % correct | 99.6 | 92.9 | 96.9 |

z statistics in italics

controls (not reported): gravity eq., country dummies for communist rule after World War II

EEC of 6: Trade between France, Germany, Italy, Netherlands, Belgium/Luxemburg
 Austria

Euro zone: Trade between EU 15 members except for Denmark and Sweden

Communist rule: USSR, Poland, Czechoslovakia, Hungary, Yugoslavia, Bulgaria, Romania